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# Research update on host plant resistance for soybean aphid

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The availability of host plant resistance to soybean aphid could be an attractive tool to soybean producers throughout the North Central Region (Hodgson et al. 2009). The implementation of host plant resistance in a soybean IPM (integrated pest management) program would be an ideal step forward in reducing insecticide usage. However, we still need to gather "real world" data in how these resistant varieties perform throughout Iowa. Fundamental plant properties such as pod number, seed number, seed size and ultimate yield potential are all being evaluated by agronomists, but to what degree resistant plants will respond to soybean aphid still needs to be demonstrated in Iowa. Foliar insecticides have proven to be the most cost-effective method of soybean aphid control (Johnson et al. 2009), and therefore product comparisons are of interest to growers, extension personnel and members of industry.

## Comparison of conventional and Roundup Ready host plant resistant soybean

Soybean plots were established at four Iowa State University Research Farms in 2010 (Northwest, Northeast, Kanawha, Neely-Kinyon). Each location included a randomized complete block design with six treatments and four replications, including 1) untreated susceptible variety; 2) susceptible variety treated with a foliar insecticide at the economic threshold of 250 aphids per plant; 3) untreated resistant variety; 4) resistant variety treated with a foliar insecticide at 250 aphids per plant; 5) organic susceptible variety; and 6) organic resistant variety. Each plot was 0.04 acres (30 feet wide by 60 feet long) in size and was maintained according to standard agronomic practices.

Soybean aphid populations were monitored at each location every 2 weeks. At the beginning of the season, 20 plants per plot were randomly selected for whole-plant counts; the sample number decreased to 10 as plants developed. Beneficial and defoliating insects were also sampled and compared between plots and locations; however, data are not reported here. Aphid populations were very low in 2010, and so foliar applications for treatments 2 and 4 were made during the second week of August. Plots were harvested in October, and yield data (i.e., moisture and weight) for each plot were taken at each location and adjusted to 13% moisture. Sampling data from each plot were converted into cumulative aphid days to reflect seasonal pressure at each location. Total cumulative aphid days were averaged by treatment.

## Results

Aphid populations were low at each location and the economic threshold (250 aphids per plant; Ragsdale et al. 2007) was never reached (Figure 1). Cumulative aphid days were very low and well below the economic injury level, but were generally highest in the treatment 5 (organic susceptible). Yield was generally highest in treatments 1 (untreated susceptible) and 2 (susceptible with a foliar insecticide) (Figure 1). A statistical analysis between treatments and implications for soybean aphid host plant resistance management will be discussed.

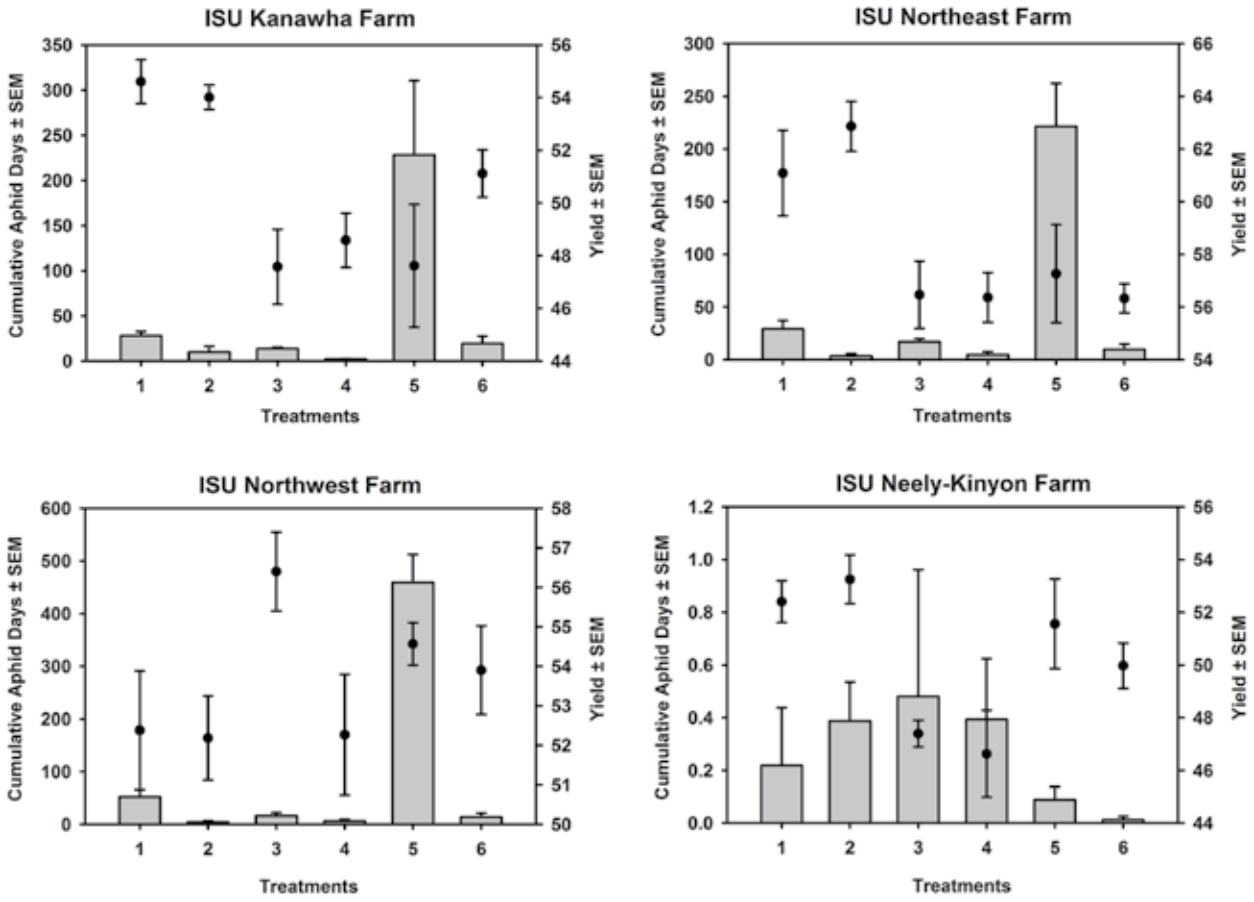


**Figure 1.** Comparison of seasonal aphid pressure and yield using conventional and Roundup Ready soybean. Cumulative aphid days is shown with grey bars (± standard error of the mean) and yield in bushels per acre is shown with dots (± standard error of the mean) for each location sampled in 2010.

## Comparison of foliar insecticides

Soybean plots were established at two Iowa State University Research Farms in 2010 (Northeast and Johnson). Each location included a randomized complete block design with four replications. The Northeast Farm had 36 treatments and the Johnson Farm had 27 treatments. We are reporting on 26 and 19 treatments, respectively, because of proprietary product restrictions. The treatment list is described in Table 1. Each plot was 0.02 acres (15 feet wide by 50 feet long) in size was maintained according to standard agronomic practices. Some treatments were replicated at each location at the request of industry sponsors.

Soybean aphid populations were monitored in the first five treatments at each location every week in June and July. All treatments were sampled weekly for aphids in August. At the beginning of the season, 20 plants per plot were randomly selected for whole-plant counts; the sample number decreased to 5 as plants developed. Beneficial and defoliating insects were also sampled and compared between plots and locations; however, data are not reported here. Aphid populations were very low in 2010, and so foliar treatment applications were made during the second week of August. Plots were harvested in October, and yield data (e.g., moisture and weight) were taken at each location and adjusted to 13% moisture. Sampling data were converted into cumulative aphid days to reflect seasonal pressure at each location.

**Table 1.** List of treatments used in 2010 soybean aphid efficacy trial.

| Location - Northeast Farm<br>Treatment and Rate[1] | Location - Johnson Farm<br>Treatment and Rate[1] |
|---|---|
| 1. Untreated control | 1. Untreated control |
| 2. Warrior II @ 1.6 oz + Lorsban Advanced @ 1 pt | 2. Warrior II @ 1.6 oz + Lorsban Advanced @ 1 pt |
| 3. CruiserMaxx Beans with Rag1 (ST)[2] | 3. Warrior II at threshold (250 aphid/plant) |
| 4. Warrior II at threshold (250 aphid/plant) | 4. CruiserMaxx Beans with Rag1 (ST)[2] |
| 5. CruiserMaxx Beans (ST)[2] | 5. CruiserMaxx Beans (ST)[2] |
| 6. Lorsban Advanced @ 2 pt | 6. Lorsban Advanced @ 2 pt |
| 7. Steward @ 6.7 oz | 7. Belay @ 3 oz |
| 8. Asana XL @ 9.6 oz | 8. Belay @ 4 oz |
| 9. Asana XL @8 oz + Lannate @ 8 oz | 9. Belay @ 6 oz |
| 10. Belay @ 3 oz | 10. Belay @ 3 oz + Lorsban Advanced @ 1pt |
| 11. Belay @ 4 oz | 11. Hero @ 10.3 oz |
| 12. Belay @ 6 oz | 12. Belay @ 3 oz + Brigade @ 4 oz |
| 13. Belay @ 3 oz + Lorsban Advanced @ 1pt | 13. Brigade @ 6.4 oz |
| 14. Hero @ 10.3 oz | 14. Endigo ZC @ 4.5 + Thiamethoxam @ 2.58 oz |
| 15. Belay @ 3 oz + Brigade @ 4 oz | 15. Belay @ 3 oz |
| 16. Brigade @ 6.4 oz | 16. Belay @ 3 oz + Brigade @ 4 oz |
| 17. Endigo ZC @ 4.5 + Thiamethoxam @ 2.58 oz | 17. Belay @ 3 oz + Asana XL @ 6 oz |
| 18. Warrior II @ 1.6 oz | 18. Endigo ZC @ 4.5 oz + Thiamethoxam @ 2.58 oz |
| 19. Cobalt Advanced @ 11 oz | 19. Belay @ 3 oz + Danitol @ 8 oz |
| 20. Cobalt Advanced @ 13 oz | |
| 21. Declare @ 1.02 oz | |
| 22. Declare @ 1.28 oz | |
| 23. Declare @ 1.02 oz + NuFos 4E @ 12 oz | |
| 24. Mustang Max @ 2 oz | |
| 25. Hero @ 5 oz | |
| 26. Hero @ 4 oz | |

[1] Rates are given per acre of active ingredient.
[2] ST = seed treatment.

## Results

There was significant standing water at the Johnson Farm throughout the 2010 summer which impacted the quality of certain plots. Aphid populations were low at each location and the economic threshold was never reached. Cumulative aphid days were very low and well below the economic injury level (Figure 2). With a widespread lack of aphid pressure in 2010, a seed treatment was not a cost-effective means of control (Johnson et al. 2009). A statistical analysis between treatments and implications for insecticide stewardship will be discussed.

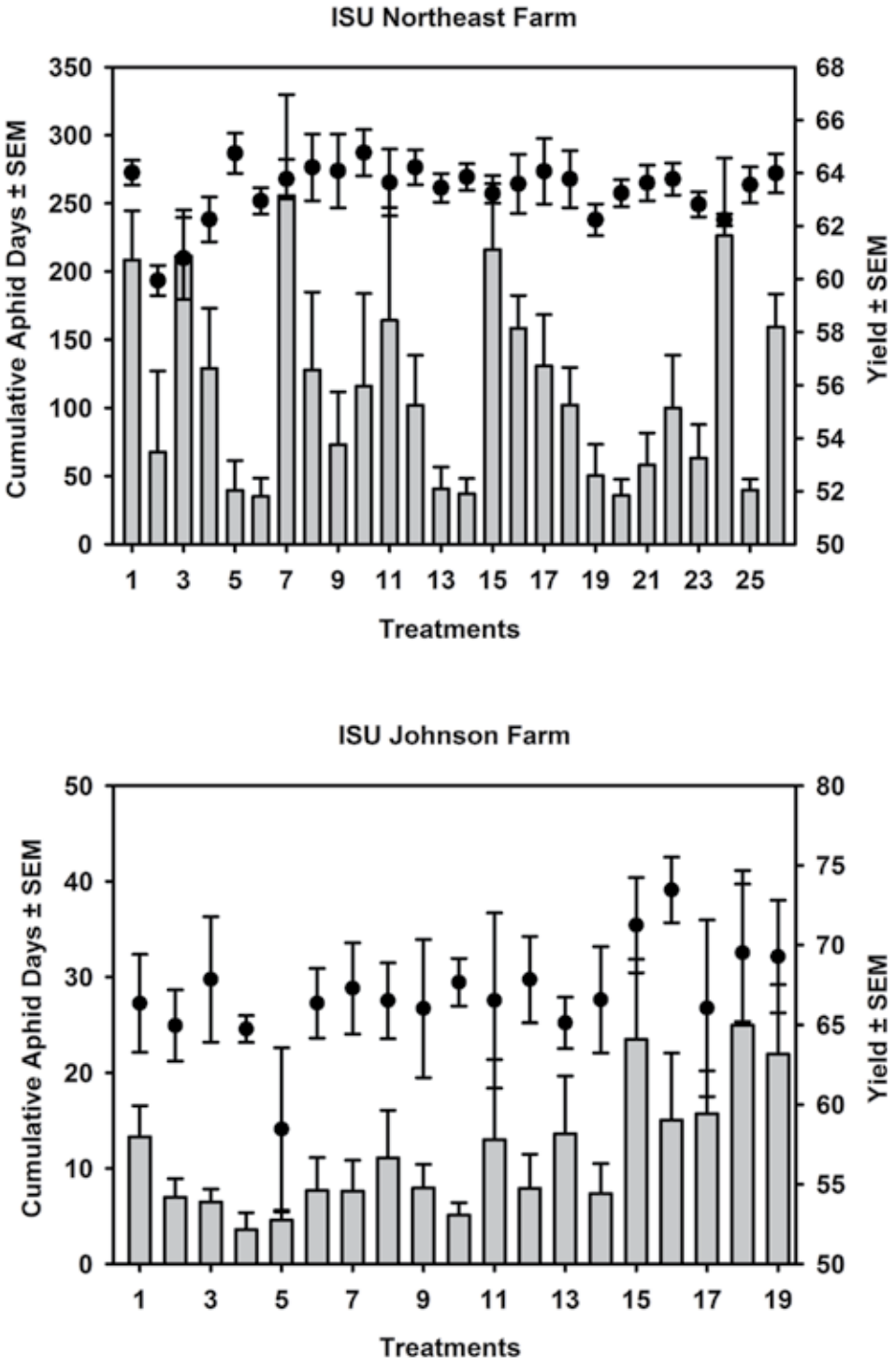


**Figure 2.** Comparison of seasonal aphid pressure and yield using combinations of seed treatments and foliar insecticides. Cumulative aphid days is shown with grey bars (± standard error of the mean) and yield in bushels per acre is shown with dots (± standard error of the mean) for each location sampled in 2010.

## Acknowledgments

We thank the ISU Farm Managers (Jeff Butler, Ken Pecinovsky, David Rueber, Ryan Rusk) for planting and harvesting plots, and Greg VanNostrand for making insecticide treatments. We would like to recognize the Iowa Soybean Association for partial financial support for Robert Bruner, an entomology graduate student, who collected data for this project.

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## Additional reference

To see the full statistical analysis of the 2010 soybean aphid efficacy evaluation, including previous evaluations since 2005, visit http://www.ent.iastate.edu/soybeanaphid/.